CLAIMS

1. A solar cell module comprising:-

   iv) a rigid or flexible superstrate and/or substrate;

   v) one or more solar cells, and

   vi) a cured liquid silicone encapsulant selected from the group of a hydrosilylation cure reaction product, a peroxide cure reaction product and a UV cure reaction product.

2. A solar cell module in accordance with claim 1 wherein the solar cell is either a wafer or a thin film and wherein said solar cell is made from crystalline or polycrystalline silicon or thin film silicon, e.g. amorphous, semi crystalline silicon, gallium arsenide, copper indium diselenide, cadmium telluride, copper indium gallium diselenide, mixtures including any one or more of the latter.

3. A solar cell module in accordance with claim 1 or 2 wherein the solar cell is a wafer made from polycrystalline or single crystal silicon.

4. A solar cell module in accordance with claim 1 or 2 wherein the solar cell is a thin film made from thin film silicon, or copper indium gallium diselenide.

5. A solar cell module in accordance with any preceding claim wherein the viscosity of the final liquid silicone encapsulant composition is preferably from 100 to 10 000 mPa.s measured at 25°C.

6. A solar cell module in accordance with any preceding claim wherein the liquid silicone encapsulant comprises

   Component (A) 100 parts by weight of a liquid diorganopolysiloxane having at least two Si-alkenyl groups per molecule and a viscosity at 25°C of from 100 to 15,000 mPa.s;

Component (B) 20 to 50 parts by weight of a silicone resin containing at least two alkenyl groups;

Component (C) a cross-linking agent in the form of a polyorganosiloxane having at least two silicon-bonded hydrogen atoms per molecule, in an amount such that the ratio of the number of moles of silicon-bonded hydrogen to the total number of moles of silicon-bonded alkenyl groups is from 0.1: 1 to 5: 1;

Component (D) a hydrosilylation catalyst wherein the amount of metal in said hydrosilylation catalyst is from 0.01 to 500 parts by weight per 1,000,000 parts by weight of component (A).

7. A solar cell module in accordance with claim 6 wherein the ratio of the number of moles of silicon-bonded hydrogen to the total number of moles of silicon-bonded alkenyl groups in component (A) is >1:1.

8. A solar cell module in accordance with claim 6 or 7 wherein the composition additionally comprises one or more adhesion promoter(s) and/or an anti-soiling agent(s) and/or cure inhibitor(s) and/or a silane of the formula:-

$$(R^1O)_3Si\,R^2$$

wherein R^1 is an alkyl group comprising 1 to 6 carbon atoms, R^2 is selected from the group of an alkoxy group comprising 1 to 6 carbon atoms, an alkyl group comprising1 to 6 carbon atoms an alkenyl group comprising 1 to 6 carbon atoms, an acrylic group or an alkyl acrylic group.

9. A solar cell module in accordance with any preceding claim wherein there is provided an adhesive layer comprising a liquid silicone adhesive adapted to adhere solar cells on to a superstrate or substrate.

10. A solar cell module in accordance with any preceding claim wherein the viscosity of the final liquid silicone encapsulant composition is preferably

from 100 to 2000 mPa.s measured at 25°C

11. A solar cell module in accordance with claim 9 or 10 wherein the liquid silicone adhesive comprises :-

Component (Ai) 100 parts by weight of a liquid diorganopolysiloxane having at least two Si-alkenyl groups per molecule and a viscosity at 25°C of from 100 to 10,000 mPa.s;

Component (Bi) 20 to 40 parts by weight of a silicone resin containing at least two alkenyl groups;

Component (Ci) a cross-linking agent in the form of a polyorganosiloxane having at least two silicon-bonded hydrogen atoms per molecule, in an amount such that the ratio of the number of moles of silicon-bonded hydrogen to the total number of moles of silicon-bonded alkenyl groups is from 0.1: 1 to 1: 1;

Component (Di) a hydrosilylation catalyst wherein the amount of metal in said hydrosilylation catalyst is from 0.01 to 500 parts by weight per 1,000,000 parts by weight of component (Ai)..

12. A solar cell module in accordance with claim 6 wherein the ratio of the number of moles of silicon-bonded hydrogen to the total number of moles of silicon-bonded alkenyl groups in component (A) is <1:1.

13. A solar cell module in accordance with claim 11 or 12 wherein the adhesive composition additionally comprises an adhesion promoter and/or a cure inhibitor and/or a silane of the formula:-

$$(R^1O)_3Si\,R^2$$

wherein R^1 is an alkyl group comprising 1 to 6 carbon atoms, R^2 is selected from the group of an alkoxy group comprising 1 to 6 carbon atoms, an alkyl

group comprising1 to 6 carbon atoms an alkenyl group comprising 1 to 6 carbon atoms, an acrylic group or an alkyl acrylic group.

14. A solar cell module comprising an adhesive and an encapsulant wherein the encapsulant comprises a resin fraction of between 20% to 90% by weight and the adhesive has a resin fraction of from 20- 30 % by weight.

15. A solar cell module in accordance with any preceding claim wherein the encapsulant cures without releasing volatiles.

16. A solar cell module in accordance with any preceding claim wherein the cured silicone encapsulant and/or adhesive exhibits a light transmission substantially equivalent to glass.

17. A solar cell module in accordance with any preceding claim wherein the solar cell or series of solar cells are pre-treated prior to adhesion and/or encapsulation with a silane of the formula:-

$$(R^1O)_3Si\ R^2$$

wherein R^1 is an alkyl group comprising 1 to 6 carbon atoms, R^2 is selected from the group of an alkoxy group comprising 1 to 6 carbon atoms, an alkyl group comprising1 to 6 carbon atoms an alkenyl group comprising 1 to 6 carbon atoms, an acrylic group or an alkyl acrylic group.

18. A continuous solar cell module encapsulation process comprising the steps of uniformly applying by spraying, coating or dispensing a predetermined volume of a liquid silicone encapsulant onto a solar cell module and curing said encapsulant thermally or by infrared radiation.

19. A continuous solar cell module encapsulation process in accordance with claim 17 with an encapsulant in accordance with any one of claims 5 to 8.A continuous solar cell module encapsulation process in accordance with claim

17 or 18 wherein the liquid silicone encapsulant is applied using a curtain coater.

20. A continuous solar cell module encapsulation process in accordance with any one of claims 17 to 19 wherein the liquid silicone encapsulant is cured in a continuous oven.

21. A continuous solar cell module encapsulation process in accordance with any one of claims 17 to 20 wherein the resulting layer of encapsulant is a uniform thin film coating having a thickness ranging from 20 μm to 1200 μm.

22. A continuous solar cell module encapsulation process in accordance with any one of claims 17 to 20 wherein a liquid silicone adhesive is applied on to the module and cured prior to the introduction of the encapsulant.

23. A continuous solar cell module encapsulation process in accordance with claim 21 wherein the liquid silicone adhesive has a composition in accordance with any one of claims 11 to 13.

24. A continuous solar cell module encapsulation process in accordance with any one of claims 17 to 23 wherein the means of applying the encapsulant is adapted such that encapsulant is applied in a uniform bubble-free or substantially bubble-free film on the top of a solar cell in the module.

25. A continuous solar cell module encapsulation process in accordance with any one of claims 17 to 24 wherein deposition of a solar cell or series of solar cells into a first layer liquid silicone encapsulant or liquid silicone adhesive is by a vacuum gripper controlled by six-axis robot, or other automatic placement, and a seventh axis or other gripper is utilised to control the placement of the solar cell array into a very thin liquid layer of 100 to 700 μm.

26. A continuous solar cell module encapsulation process in accordance with any

one of claims 17 to 24 where a thermoplastic or thermo-elastomeric material is applied to form a frame surrounding a cured module to protect the edges of the panel from water ingress.

27. A continuous solar cell module encapsulation process solar cell module in accordance with any one of claims 17 to 24 wherein a silane of the formula:-

$$(R^1O)_3Si\,R^2$$

wherein R^1 is an alkyl group comprising 1 to 6 carbon atoms, R^2 is selected from the group of an alkoxy group comprising 1 to 6 carbon atoms, an alkyl group comprising1 to 6 carbon atoms an alkenyl group comprising 1 to 6 carbon atoms, an acrylic group or an alkyl acrylic group; is utilised to pre-treat a solar cell or series of solar cells prior to adhesion and/or encapsulation.

28. Use of a liquid silicone encapsulant to encapsulate a solar cell module.

29. Use in accordance with claim 28 wherein the encapsulant is a composition in accordance with any one of claims 5 to 9.

30. A solar cell module obtainable by the method in accordance with any one of claims 17 to 26.